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Resting-State Functional Connectivity of Cerebellar Lobules in Schizophrenia

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Introduction

The cerebellum, traditionally recognized as a motor modulator, also contributes to cognitive functions through pattern recognition, error detection, and coordination via connections with the cortex. The cognitive dysmetria theory proposes that disrupted connectivity within the cortico-cerebellar-thalamic-cortical circuit may underlie symptoms of schizophrenia such as hallucinations and delusions (Andreasen et al., 1998; Sheffield and Barch, 2016). Neuroimaging research has identified differences in cerebellar-cortical connectivity in individuals with schizophrenia (Buckner et al., 2011; Chen et al., 2013), but few studies have investigated the connectivity between individual cerebellar lobules with the rest of the brain and their connection to symptoms or cognitive impairment in schizophrenia. This study will examine patterns of resting-state functional connectivity (FC) of 20 cerebellar lobules of healthy controls (HC) and patients with schizophrenia or schizoaffective disorder (SZ), hypothesizing reduced cerebellar connectivity in SZ compared to HC.

Methods

Participants include 89 HC and 76 SZ individuals from the Mind Research Network Center for Biomedical Research Excellence (COBRE) study, that underwent a resting-state functional magnetic resonance imaging (fMRI) scan. Resting-state FC of 20 lobular regions of interest within the cerebellum was calculated using the Data Processing Assistant for Resting State fMRI, Advanced edition. This provided seed-to-voxel maps of time-course correlations across the entire brain for each of the cerebellar regions. One-sample t tests were utilized to map regions of connectivity significantly different from 0 within the HC and SZ groups. Two-sample t tests compared the connectivity extent of individual lobules between groups.

Results

Connectivity T maps revealed that overall cerebellar connectivity was qualitatively greater in HC than SZ. Average extent of connectivity from each lobule was significantly greater in HC (28373 voxels) than SZ (7504 voxels) as well ($t = 10.18$; $p < .001$).

Conclusions/Discussions

This study demonstrates that global cerebellar connectivity is qualitatively different in SZ compared to HC, which is essential for future mapping of cerebellar dysfunction in schizophrenia. Future research will map maximal connectivity of each lobule to specific cortical clusters to compare to previous connectivity maps from the cortex to the cerebellum.

Furthermore, relationships between cognitive and clinical measures and connectivity will be explored.

Key words: Schizophrenia, cerebellum, resting-state functional connectivity, cognitive dysmetria, neuroimaging

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